# REVA: A Case Study at a Marine Corps Installation

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# Outline

- Overall Program
- REVA Process
- REVA Case Study
- Next Steps
- Acknowledgements

# Program Goals

- Assess the potential for munitions constituents (MC) to migrate off operational ranges and identify potential impacts (human health and the environment)
- Provide information for Range Management Plans
- Enhance Service's stewardship and outreach programs
- Assist Senior leadership decision making to improve sustainable range management

# Primary Program Drivers

- DODD 3200.15
- DODD 4715.11
- DODI 4715.14
- OSD Policy on Required Actions Related to Perchlorate (26 Jan 2006) – in revision
- EPA Perchlorate Memo (8 January 2009)

# REVA Process

- Conduct Site Visit / Data Collection
- Develop Conceptual Site Model (CSM)
- Perform Small Arms Range Assessments
- Prepare and employ screening-level fate and transport modeling, if applicable
- Conduct further assessment / field work, if applicable
- Document conclusions

# REVA Case Study

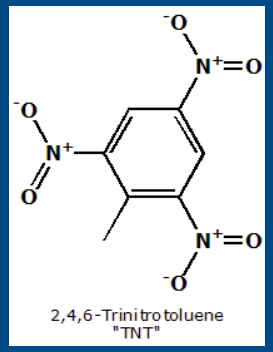
# Data Collection

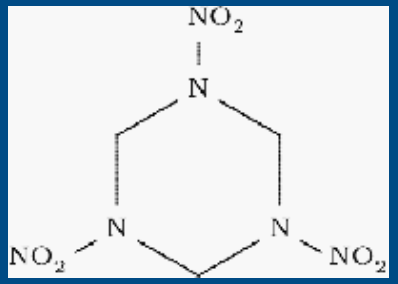
- Total of 47 ranges / training areas assessed
  - Live fire training areas
  - Artillery firing areas
  - Mortar firing positions
  - Maneuver areas
  - Small arms ranges
  - Explosive Ordnance Disposal range

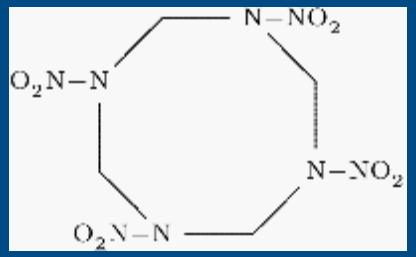
- Of the 47 ranges, three areas were identified for modeling
  - A Impact Area
  - B Impact Area
  - C Impact Area

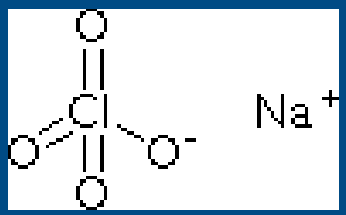
# Basic MC Loading Assumptions

- Expenditure data, where available
- Indicator MC include TNT, RDX, HMX, Perchlorate, and Lead
- Main filler of the munitions considered majority of loading
- MC loading estimated for the entire time the range was operational
- MC Loading areas based upon discussions with range control, GIS/mapping data and target locations





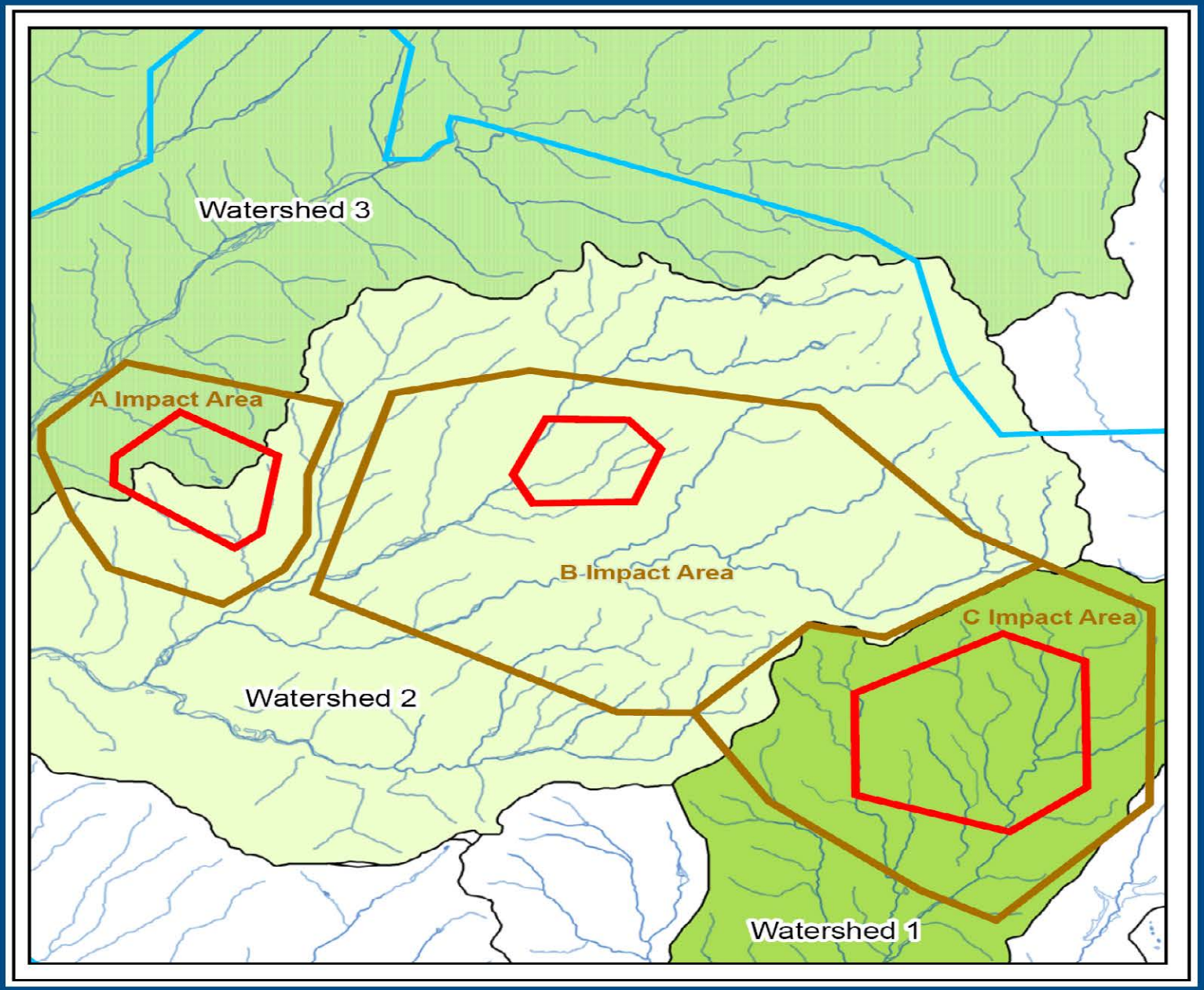


# MC Loading

- A Impact Area
  - 1938-Present
    - TNT, RDX, HMX, Perchlorate
- B Impact Area
  - 1938-Present
    - TNT, RDX, HMX, Perchlorate
- C Impact Area
  - 1938-Present
    - TNT, RDX, HMX, Perchlorate

# Conceptual Site Model

- Varying topography and slope
- 3 MC loading areas located in 3 different hydrologic watersheds
- 22 inches of precipitation yearly average
- Surface water recharges groundwater
- Groundwater aquifer (up to 30 ft bgs) provides water supply
- Receptors
  - Human – groundwater water supply
  - Ecological – surface water streams


Watershed 3
A Impact Area
B Impact Area
C Impact Area
Watershed 2
Watershed 1

# Overview of Screening-Level Surface Water Analysis

$$\frac{\text{MC Mass from Soil to Surface Water}}{\text{Surface Water Runoff Estimate}} = \text{"Edge of MC Loading Area" MC Concentration in Surface Water}$$

X Down Gradient Mixing Factor

Compare to REVA Trigger Values

= "Mixed" MC Concentration in Surface Water

# Overview of Screening-Level Groundwater Analysis

$$\frac{\text{MC Mass}}{\text{Infiltration}} = \text{Concentration of Infiltrating water}$$

Compare to REVA Trigger Values

Unsaturated Zone Modeling (VS2DTi or VLEACH)

Vertical movement of MC from surface to GW →

Does MC concentration reach water table above REVA trigger values ?

Saturated Zone Modeling (Biochlor)

Horizontal movement of MC in GW →

Does MC concentration reach receptor or range boundary above REVA trigger values ?

# A Impact Area Modeling Results

- Surface water
  - MC predicted below REVA trigger values for all indicator MC
- Groundwater
  - MC predicted below REVA trigger values for all indicator MC

# A & B Impact Areas
# Modeling Results

- Surface water
  - MC predicted above REVA trigger values for TNT and RDX off range
- Groundwater
  - MC predicted above REVA trigger values for TNT and RDX at estimated down gradient drinking water supply well locations

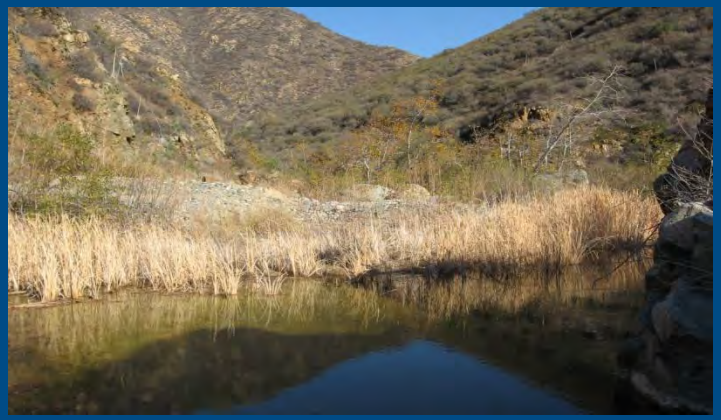
# C Impact Area
# Modeling Results

- Surface water
  - MC predicted above REVA trigger values for TNT and RDX off range
- Groundwater
  - MC predicted above REVA trigger values for TNT and RDX at estimated down gradient drinking water supply well locations

# Further Assessment

## Sampling Conducted in 2 Watersheds

- Surface water - sampled  up to 4 off-range locations where road intersects streambeds
- Groundwater - sampled up to 7 drinking water supply wells
- Analytes included full explosives suites and lead



# Watershed 1 Sampling Results

- Groundwater
  - Explosives - Non detect
  - Lead - Below Draft DoD Screening Values
- Surface Water
  - Explosives – Non detect
  - Lead - Below Draft DoD Screening Values after specific hardness was calculated

# Watershed 2 Sampling Results

- Groundwater
  - Explosives - 2-nitrotoluene (2-NT) detected below Draft DoD Screening Values in original samples. Non detect in subsequent samples.
  - Lead – Detected below Draft DoD Screening Values in original samples. Non detect in subsequent samples.
- Surface Water
  - Explosives - 2-NT, 3-NT detected below Draft DoD Screening Values. RDX detected below DoD Screening Values in original samples but non detect in subsequent samples.
  - Lead - At the Draft DoD Screening Value after specific hardness was calculated.

# Assessment Conclusion

- No current off range migration of MC posing an unacceptable risk to human health or the environment
- Detected MC concentrations decreased over sampling events
- Further actions may be evaluated to continue mitigating the possibility of MC migration

# REVA Documentation

- Draft report developed
- Reviewed by outside 3rd party
- Draft Final (publicly releasable document)
  - 60 day courtesy review regulator notification period
  - Sent directly with cover letter to agencies identified by installation
- Final (publicly releasable document)
  - Posted on installation website

# Next Steps

- Continue regular surface water monitoring
- Re-assess per DoDI beginning in 2014
- Evaluate best management practices to control MC migration within Watershed 2

# Acknowledgements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# Questions?


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